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(54) **RACK APPARATUS FOR TREATMENT PROCESSES**

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See application file for complete search history.

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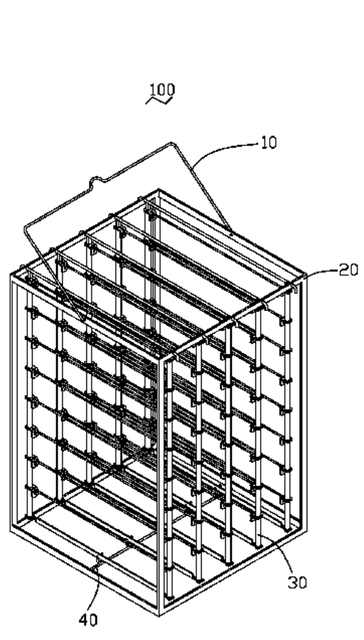
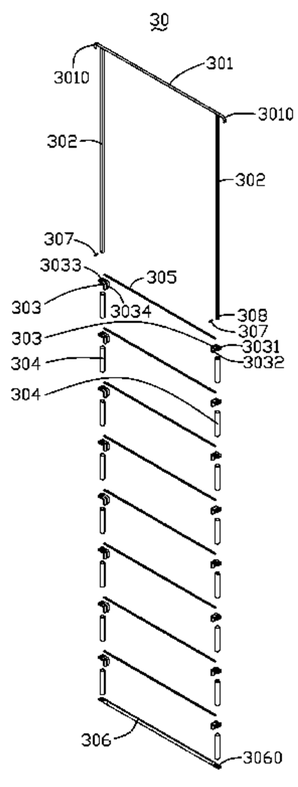
(57) **ABSTRACT**

A rack apparatus (**100**) for facilitating workpiece treatment includes a frame member (**20**) and a plurality of rack members (**30**). The rack members are detachably mounted on the frame member, wherein each rack member, in turn, includes a plurality of rack poles (**305**) that are detachably mounted thereon. When workpieces of large dimension or complicated shape require hanging/mounting on the rack apparatus, some rack poles and rack members can be disassembled, and thus the rack apparatus can provide more space to contain/carry these workpieces.

13 Claims, 4 Drawing Sheets





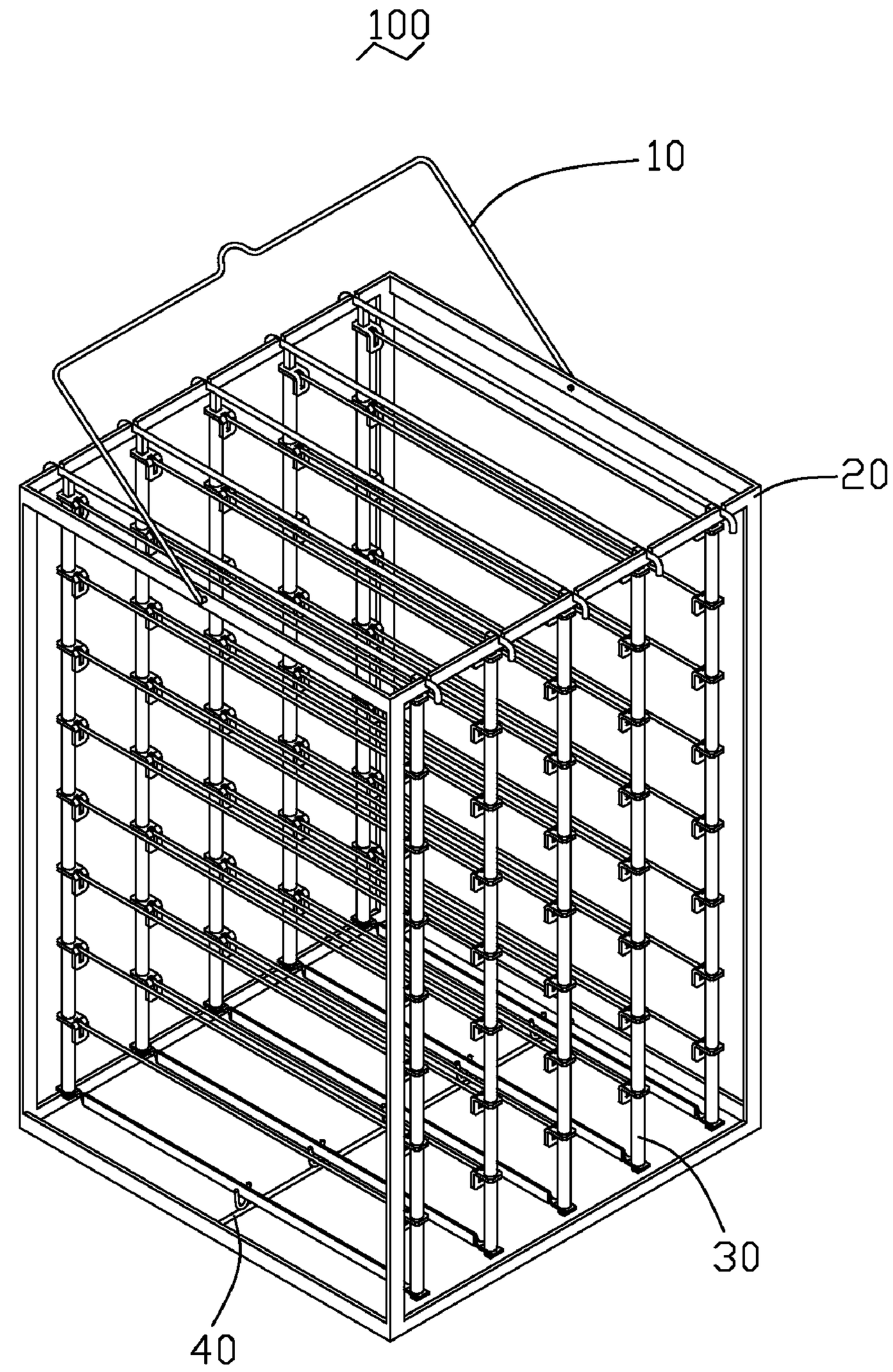


FIG. 1

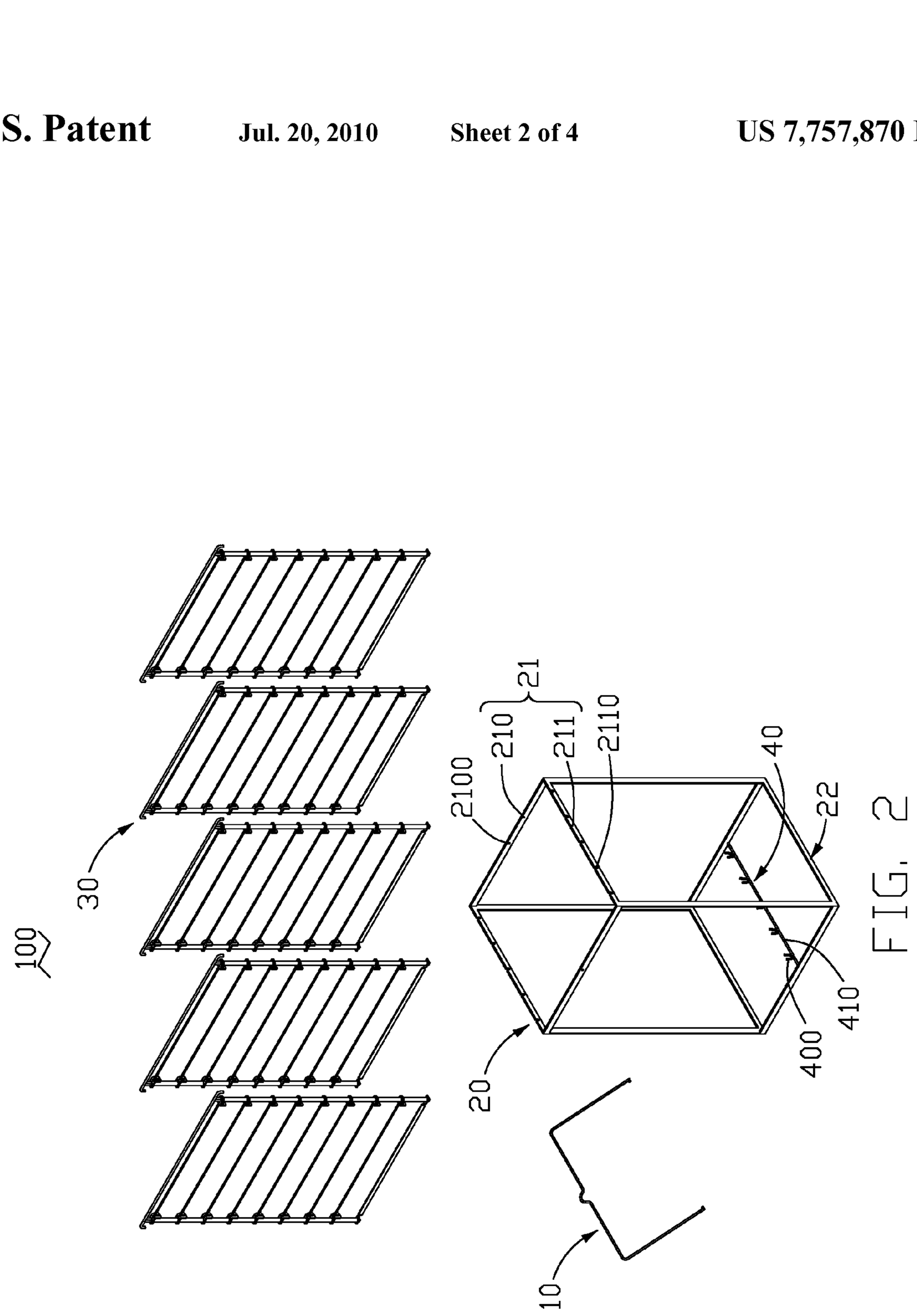


FIG. 2

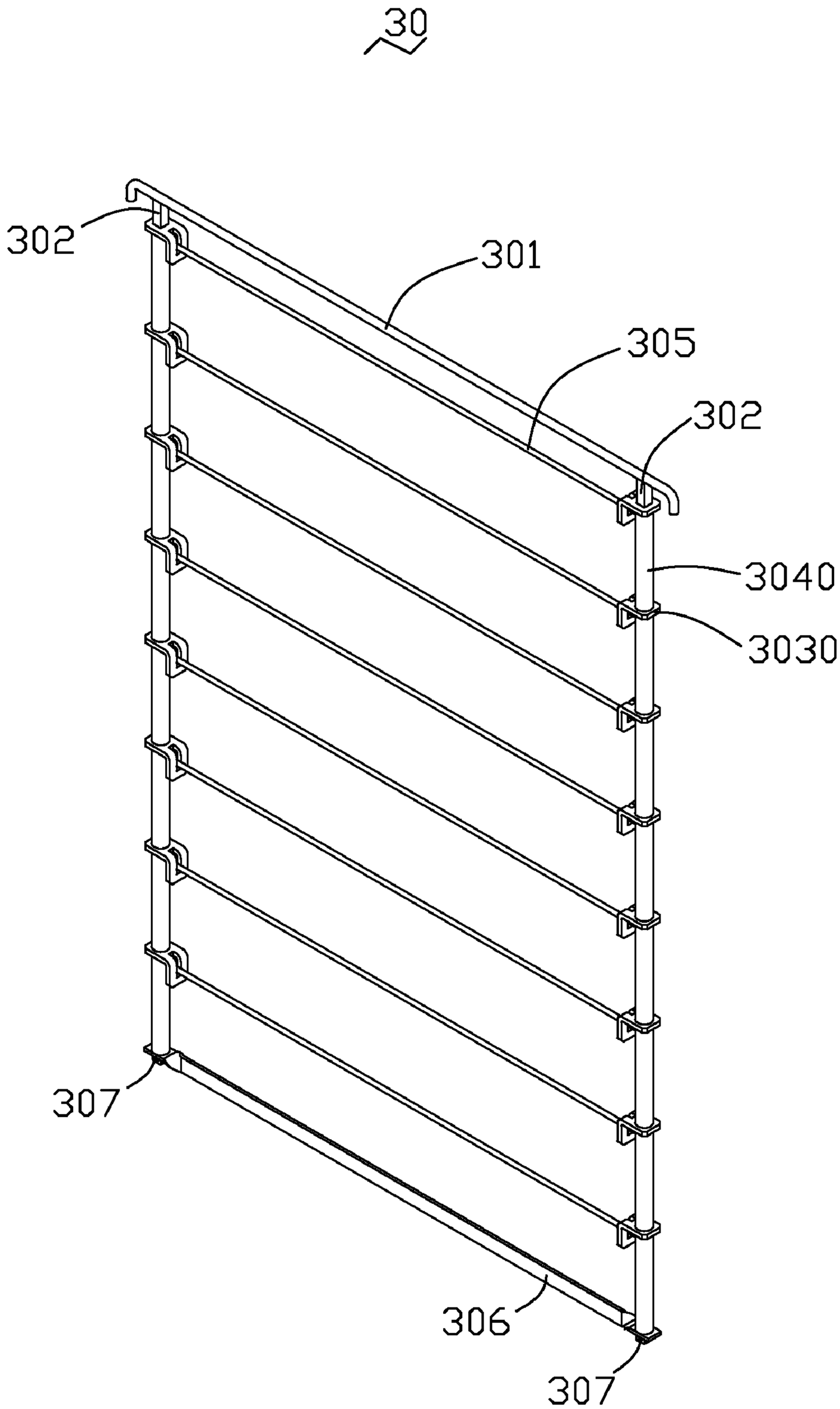


FIG. 3

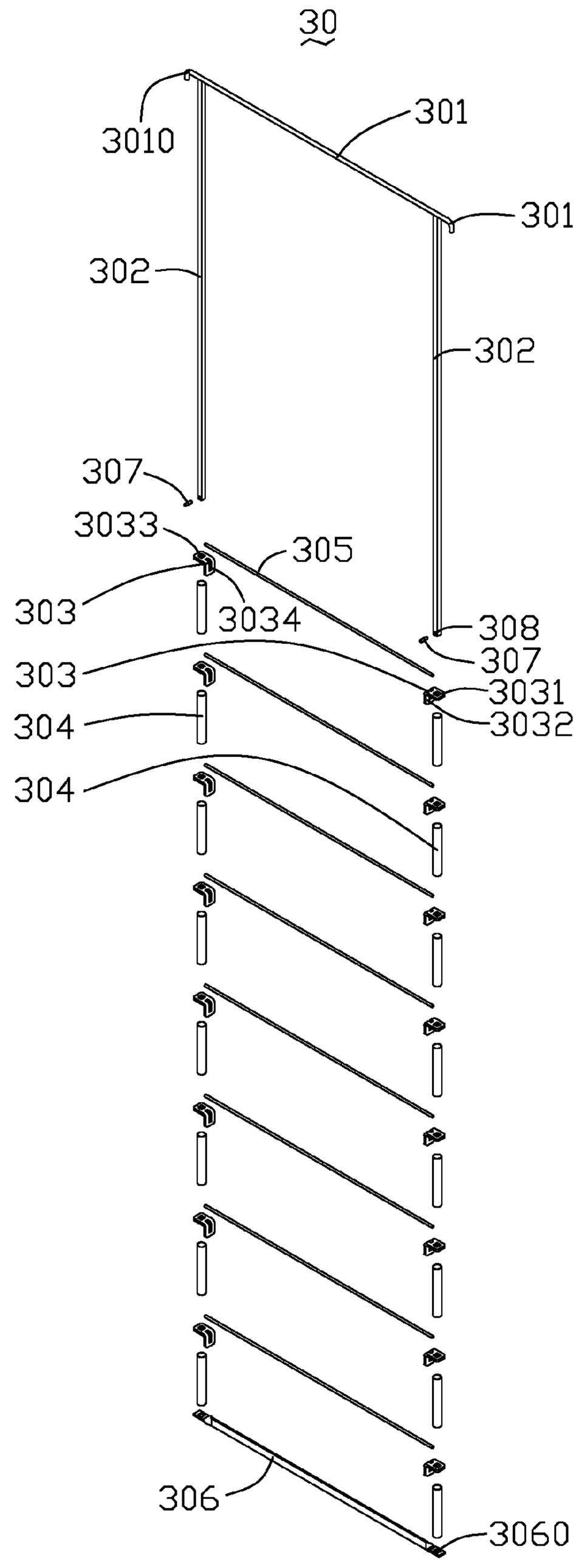

30
3010
301
3010
302
302
307
3033
305
303
3034
308
307
303
3031
3032
304
304
306
3060

FIG. 4

RACK APPARATUS FOR TREATMENT PROCESSES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a rack apparatus, and, particularly, to a rack apparatus used to hang workpieces during operating/treating processes, such as plating, washing, coloring, etc.

2. Description of Related Art

Rack apparatuses are widely used to hang/carry workpieces during operating/treating processes such as plating, washing, coloring, etc. Generally, a typical rack apparatus has a special shape and dimension that can be only used in one kind of operating process, and the typical rack apparatus can only hang/carry workpieces having special shapes and dimensions for which the rack apparatus was particularly designed to accommodate.

Therefore, when workpieces requiring a plurality of operating processes are processed, typically, a plurality of kinds/configurations of rack apparatuses are used in an operating line, wherein each kind of rack apparatus corresponds to a kind of operating process and/or a particular workpiece to be carried thereby. The workpieces are hung onto different kinds of rack apparatuses to be processed, in order. At the end of each operating process, the workpieces are taken off the rack apparatuses and hung on other rack apparatuses for the next process. Thus a great deal of time and work is generally consumed in the aforementioned operation. Additionally, when workpieces having shapes and dimensions that do not match the rack apparatuses installed on the operating line are manufactured and/or treated, all rack apparatuses must be replaced by new rack apparatuses that match these workpieces. In this way, the cost of this kind of processing may be made prohibitively expensive.

Therefore, an improved rack apparatus is desired in order to overcome the above-described shortcomings.

SUMMARY

A rack apparatus includes a frame member and a plurality of rack members. The rack members are detachably mounted on the frame member, and each rack member includes a plurality of rack poles detachably mounted thereto.

Other advantages and novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the present rack apparatus can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present rack apparatus. Moreover, in the drawings, like reference numerals designate corresponding parts through out the several views.

FIG. **1** is an assembled view of a rack apparatus, in accordance with a present embodiment;

FIG. **2** is a disassembled view of the rack apparatus shown in FIG. **1**;

FIG. **3** is an assembled view of a rack member of the rack apparatus shown in FIG. **1**; and

FIG. **4** is a disassembled view of the rack member shown in FIG. **3**.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings in detail, FIG. **1** and FIG. **2** show a rack apparatus **100**, in accordance with a present embodiment. The rack apparatus **100** includes a hanging member **10**, a frame member **20**, a plurality of rack members **30** and a holding member **40**. The hanging member **10** is mounted directly to/on a top of the frame member **20**. The rack members **30** are detachably mounted on the frame member **20**. The holding member **40** is mounted on a bottom of the frame member **20** to hold the rack members **30** in a desired position/orientation during at least one given processing step.

The hanging member **10** is an approximately U-shaped metal pole with two approximately parallel arm portions, and two respective distal ends of the arm portions of the hanging member **10** extend towards each other. The arm portions of the hanging member display a spring/elastic quality, which helps facilitate a selectably detachable mounting of the hanging member to the frame member **20**. The frame member **20** is advantageously made of a mechanically and chemically durable metal, such as a stainless steel or titanium alloy. The frame member **20** is usefully cubical or rectangular parallelepiped in shape and, to attain such a shape, is formed from twelve metal poles via welding or bolting together. Of course, if another frame shape should be desired, the number of poles could be adjusted. Also, the number of poles could, potentially, be increased if reinforcement is desired, even if a cubical or parallelepiped shape is employed. The frame member **20** includes a rectangular top frame **21** and a rectangular bottom frame **22**, parallel to the top frame **21**. The top frame **21** is formed by two parallel hanging poles **210** and two parallel fixing poles **211**, perpendicular to the hanging poles **210**. Each hanging pole **210** defines a hanging hole **2100** in its middle portion, and a diameter of the hanging hole **2100** is larger than a width of each end of the hanging member **10**. Each distal end of the hanging member **10** respectively is slidably received in a corresponding hanging hole **2100**. Due to the spring quality of the hanging member **10**, the distal ends of the hanging member **10** are effectively retained in the hanging holes **2100**. Each fixing pole **211** defines a plurality of fixing apertures **2110** therein to allow assembly/mounting of the rack members **30**, and the fixing apertures **2110** are, beneficially, arranged equidistantly. It is, however, understood that such apertures **2110** could be arranged in some other configuration (i.e., non-equidistant spacing).

Also referring to FIG. **3** and FIG. **4**, the rack members **30** are, advantageously, made of a durable (i.e., both mechanically and chemically) metal, such as stainless steel or titanium alloy. Each rack member **30** beneficially includes, at least, a top pole **301**, two supporting poles **302**, a plurality of fixing components **303**, a plurality of spacing pipes **304**, a plurality of rack poles **305**, a bottom pole **306**, and two holding bolts **307**. Each end portion of the top pole **301** extends co-directionally with the other end portion thereof and approximately perpendicular to a main portion of the top pole **301**. Thus, two connecting hooks **3010** are formed on the two ends of the top pole **301**, each such connecting hook **3010** downwardly alongside yet spaced from the rack member **30**. A width of each connecting hook **3010** is, usefully, slightly smaller that that of each fixing aperture **2110** to facilitate a sliding fit therebetween. That is, a detachable fit is desired therebetween, but an accidental disassembly of such during processing would best be avoided. These parameters help dictate the type of fit desired here. Each supporting pole **302** further defines a screw hole **308** in at least an end thereof to which the bottom pole **306** is to be affixed.

The holding member **40** is made of a durable metal (i.e., both mechanically and chemically), such as a stainless steel or titanium alloy. The holding member **40** opportunely includes, at least, a plurality of holding components **400** and a holding pole **410**. The holding components **400** are, beneficially, semicircular loops mounted on the holding pole **410** via, e.g., welding or casting for holding the rack members **30** in their proper positions. Such semicircular loops are directed to open upwardly toward a top of the frame member **20**. By having the holding components **400** be such upwardly-directed semicircular loops, such loops are able to matingly receive a corresponding bottom bar **306** of a respective rack member **30** therein, as each bottom bar **306** is primarily cylindrical, except at the ends thereof.

Each fixing component **303** is formed by a bent/angled metal piece (e.g., about a 90° bend), again formed of a durable metal as per the other components of the rack apparatus **100**. The fixing component **303** usefully includes, at least, a connecting portion **3031** and a rack portion **3032**, approximately perpendicularly connected (e.g., integrally) to the connecting portion **3031**. The connecting portion **3031** defines a connecting hole **3033** therein, and a diameter of the connecting hole **3033** is larger than that of the supporting pole **302** to facilitate, advantageously, a slidable connection therewith. The rack portion **3032** defines a rack aperture **3034** therein, and a width of the rack aperture **3034** is larger than a diameter of the rack pole **305**. The width of the rack aperture **3034** and the diameter of the rack pole **305** are advantageously chosen to yield a slide fit therebetween. An inner diameter of each spacing pipe **304** is larger than a diameter of the supporting pole **302**, and an outer diameter of the spacing pipe **304** is larger than a diameter of the connecting hole **3033**, thereby promoting a slide fit between such parts, also. A length of each rack pole **305** is approximately equal to that of the supporting pole **302**. The bottom pole **306** defines two mounting holes **3060**, respectively, in its two corresponding ends, and a diameter of the mounting hole **3060** is larger than that of the supporting pole **302** in a manner promoting, usefully, an appropriate slide fit.

In assembly, the holding pole **410** is mounted on a middle portion of the bottom frame **22** and parallel to the fixing poles **211**, via, e.g., welding or bolting. The two supporting pole **302** are approximately perpendicularly connected to the top pole **301**, for example, via welding or bolting. The ends defining the screw holes **308** of the supporting poles **302**, respectively, extend approximately along a same direction as that of the connecting hooks **3010**, and the connected ends of the two supporting poles **302** are each positioned near their respective connecting hook **3010**. Each supporting pole **302** is, respectively, inserted into a connecting hole **3033** of a fixing component **303**. Each supporting pole **302** is then, respectively, inserted into a spacing pipe **304**. The aforementioned assembly operations can be repeated, in this way, and the fixing components **303** and the spacing pipes **304** are alternately mounted on/along the supporting poles **302**, and the rack portions **3032** are oriented approximately perpendicular to the top pole **301**.

The end of each supporting pole **302** is respectively inserted into a mounting hole **3060** of the bottom pole **306**, and each of the holding bolts **307** is respectively screwed into a screw hole **308** of the supporting pole **302** to hold the supporting poles **302** in the mounting holes **3060**. Two ends of each rack pole **305** are inserted into two respective rack apertures **3034** of two corresponding fixing components **303** mounted on the two supporting poles **302**. In this way, a plurality of rack poles **305** are detachably and equidistantly mounted in parallel between the two supporting poles **302**.

Further, the supporting poles **302** are inserted into both the fixing components **303** and the spacing pipes **304**. Resultingly, a rack member **30** is assembled. Additionally, the fixing components **303** can also be welded to the spacing pipes **304** in alternating fashion.

After a rack member **30** is assembled, the two connecting hooks **3010** of its top pole **301** are respectively placed into two corresponding fixing apertures **2110** of the frame member **20**. The bottom poles **306** are placed into the holding components **400** to hold the rack member **30**. In this way, a plurality of rack members **30** are equidistantly mounted in parallel on the frame member **20**. Alternatively, the bottom frame **22** can define a plurality of holding apertures corresponding to the fixing apertures **2110** therein, and two ends of the bottom pole **306** can be placed into the holding apertures. In this way, the holding member **40** can, potentially, be omitted. Finally, the two ends of the hanging member **10** are respectively inserted into the two hanging holes **2100**, and thus the rack apparatus **100** can be used in manufacturing.

In use, workpieces (not shown) are hung/mounted on the rack poles **305**. Understandably, the rack poles **305** and the rack members **30** can be disassembled from the rack apparatus **100** and mounted to the rack apparatus **100** again, if required. Therefore, when workpieces of a large dimension or complicated shape require hanging on the rack apparatus **100**, some rack poles **305** and rack members **30** can be disassembled, and thus the rack apparatus **100** can provide more space to contain these workpieces. Additionally, disassembling and mounting the rack poles **305** and the rack members **30** can also change the shape of the rack apparatus **100**, according to requirement. In this way, the rack apparatus **100** can be installed on the operating/processing line without being replaced, and the workpieces hung on the rack apparatus **100** do not necessarily require taking off (i.e., removal from) the apparatus **100** until processing is complete. It is to be understood that the rack apparatus **100** could be used, e.g., to accommodate/carry workpieces that hang alongside a given rack member **30** and/or that lay across a plurality of rack poles **305** of adjacent/adjoining rack members **30**. The rack apparatus **100**, as such, is not to be prejudiced by the manner that a user could choose to hold/carry workpieces therewith.

It is to be further understood that even though numerous characteristics and advantages of the present embodiments have been set forth in the foregoing description, together with details of structures and functions of various embodiments, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the present invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A rack apparatus, comprising:

a frame member including a top frame and a bottom frame parallel to the top frame,

a plurality of rack members detachably mounted on the frame member, wherein each rack member includes two supporting poles and a plurality of rack poles detachably mounted on the supporting poles; and

a hanging member mounted on the frame member, the hanging member being an approximately U-shaped metal pole including two arm portions, the two arm portions defining two respective arm ends, the arm ends extending towards each other the top frame defining a pair of hanging holes, the two arm ends are each inserted into a respective hanging hole.

2. The rack apparatus as claimed in claim 1, wherein the frame member is at least one of a cube and a rectangular parallelogram in shape.

3. The rack apparatus as claimed in claim 1, wherein the top frame includes two hanging poles and two fixing poles, each hanging pole defines one of the pair of hanging holes therein, and each fixing pole defines a plurality of fixing apertures therein.

4. The rack apparatus as claimed in claim 3, wherein the rack member includes a top pole with a main pole portion and two end pole portions, each end pole portion extends in an essentially same end direction, the end direction of each end pole portion is approximately perpendicular to the main pole portion, and a connecting book is respectively formed at each end of the top pole.

5. The rack apparatus as claimed in claim 4, wherein each of the two connecting hooks is respectively placed into a corresponding fixing aperture of the frame member.

6. The rack apparatus as claimed in 4, wherein the two supporting poles are connected approximately perpendicular to the top pole, each supporting, pole thereby respectively defining a connected end connected to the top pole; the supporting poles respectively extend along a direction identical to that of the connecting hooks, and the two supporting poles are respectively positioned near a corresponding connecting hook.

7. The rack apparatus as claimed in claim 6, wherein the rack member includes a plurality of fixing components mounted on the supporting poles, each fixing component including a connecting portion and a rack portion connected approximately perpendicularly to the connecting portion.

8. The rack apparatus as claimed in claim 7, wherein each connecting portion defines a connecting hole therein, a supporting pole being inserted into the connecting hole to mount the fixing component on the supporting pole.

9. The rack apparatus as claimed in claim 8, wherein the rack member includes a plurality of spacing pipes, the fixing components and the spacing pipes are alternately mounted along the supporting poles, and the rack portions are mounted approximately perpendicular to the top pole.

10. The rack apparatus as claimed in claim 9, wherein each rack portion defines a rack aperture therein, two ends of each rack pole are respectively inserted into two corresponding rack apertures of two corresponding fixing components respectively mounted on the two supporting poles.

11. The rack apparatus as claimed in claim 10, wherein the rack member includes a bottom pole, the bottom pole defines two mounting holes in the two respective ends thereof; each supporting pole has an extended end opposite to the connected end thereof, the extended end of each supporting pole is respectively inserted into a corresponding mounting hole, and the supporting poles are thereby held in the bottom pole.

12. The rack apparatus as claimed in claim 11, wherein the rack apparatus includes a holding member, the holding member includes a plurality of holding components and a holding pole, the holding components arc mounted on the holding pole, and the holding pole is mounted on the bottom frame.

13. The rack apparatus as claimed in claim 12, wherein the bottom poles are placed in the holding components.

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